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Knowledge of the Animal Welfare Act and Animal Welfare Regulations Influences Attitudes toward Animal Research

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Recent public-opinion polls indicate that Americans have shown a decline in support for animal experimentation, and several reports suggest a relationship between people's knowledge of animal welfare regulations and their attitudes toward animal research. Therefore, this study was designed to assess respondent's knowledge of several provisions in the Animal Welfare Act (AWA) and Animal Welfare Regulations (AWR), and determine whether exposure to elements of this legislation would influence an individual's attitudes toward the use of animals in research. A survey was used to assess knowledge of animal research regulations and attitudes toward animal research from a sample of individuals recruited through Amazon's Mechanical Turk crowdsourcing marketplace. Results from study 1 confirmed the hypothesis that respondents had little knowledge of various federal regulations that govern animal research activities. Data from study 2 revealed that exposure to elements of the AWA and AWR influenced participants' attitudes toward the use of animals in research. These results suggest that providing information to the general public about the AWA and AWR that protect laboratory animals from abuse and neglect may help alleviate concerns about using animals in research settings.

Abbreviations: ATAR, Attitudes Toward Animal Research questionnaire; AWA, Animal Welfare Act; AWR, Animal Welfare Regulations; KARR, Knowledge of Animal Research Regulations questionnaire; MTurk, Mechanical Turk.

The use of animal subjects in biomedical and behavioral research often produces emotional responses from persons on both sides of this debate. Those in favor of using animals in research may state that humans have the moral authority to conduct animal research because of the benefits to humans that are achieved through these procedures. Alternatively, opponents of animal testing often claim that humans do not have the moral authority to use animals in such activities.[6] Indeed, some researchers have hypothesized that moral judgments such as these are made on 2 levels: one that involves intuition and emotion, and the other that involves logical cognitive processing. Some have argued that emotional intuition occurs first, which is followed by the logical cognitive process that persons use to justify their decisions.[11,12] Alternatively, other evidence illustrates that moral judgments are sometimes neither logical nor consistent.[13] Regardless of the processes a person uses to come to these judgments, one fact is clear: Americans are divided on issues of using animal subjects in biomedical and behavioral research experiments.

Public-opinion polling data show that Americans are polarized regarding the use of animals in research.[16] Respondents to the cited survey[16] made judgments on a variety of social issues, including the moral acceptability of medical testing on animals. Of those respondents, 56% believed animal testing to be morally acceptable, whereas 39% believed it to be morally wrong. Likewise, other historic data have shown, over the past decade, a steady decline in support of animal experimentation among Americans 18 to 34 y old.[20] Taken together, these data suggest that there is a division among Americans regarding their judgments of the appropriateness of using animals in research.

Consistent with historic polling data,[16,20] a contemporary sample of undergraduate students demonstrated (1) a concern for animal welfare and (2) less perceived value obtained from animal research when compared with a sample of college students taken in the late 1980s.[15] One might assume that participants who do not support biomedical and behavioral testing on animals would desire strong regulations and oversight over these procedures. Contrary to this assumption, when compared with the sample from 25 y earlier, current respondents reported significantly less agreement with an item stating whether "more regulations governing the use of animal research" were needed.[15] One plausible explanation for this result is that those participants may have been unaware of the degree of federal oversight over animal research programs. Thus, when a person has little knowledge of the regulations currently in place, ascertaining the need for additional regulations would be difficult. Incidentally, several researchers have suggested educating the public about federal regulations that are in place to protect animal subjects in research experiments as a means to increase support for animal research.[5,7] In fact, troubled by the responses of student participants in one survey that measured attitudes toward animal research, one commentator stated that "we desperately need to integrate serious education regarding the science and ethics of animal research into the college curriculum. Otherwise, public 'support' for animal research may prove in the end to be no more solid and reliable than the latest whim or fancy."[19] Given the trend of declining support for animal research, it appears that this plea for more education in the college curriculum is now more pertinent than ever.

If increased education about animal testing might serve to offset negative attitudes toward animal research, it follows that

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persons with knowledge of research procedures should be more accepting of such practices. One group reported that university students who had experience with animal experimentation (through their university classes) were generally more accepting of animal research than were those without those experiences.[10] Specifically, those students who were exposed to this type of research found animal testing to be morally acceptable by a 2-to-1 margin. These findings were repeated with students who received training in medicine and veterinary sciences.[9] Although exposure to animal research may alter students' attitudes toward animal testing, students who possess positive attitudes toward animal research may be more likely to enroll in courses where animal testing is used (for example, medicine). In a review of more than 50 studies that assessed respondents' beliefs about animal use,[8] education was one of the many variables that were related to animal research attitudes, in that participants with higher levels of education were more accepting of using animals in research. The authors noted, however, that it was difficult to fully interpret this result without additional investigation.[8] That is, increased education levels in general and education in specialized areas where animal research is more common (for example, veterinary medicine, psychology) may both be involved in this relationship.

In one of the few studies that assessed participants' knowledge of federal regulations governing animal research, psychology majors were asked to identify the species covered by the Animal Welfare Act (AWA).[18] The AWA, enforced by the USDA, is legislation designed to protect animals (including those used in biomedical or behavioral research) from inhumane treatment.[1] Although many respondents accurately identified primates, dogs, and cats as species covered by the AWA, many participants incorrectly classified rats, mice, pigeons, and reptiles as AWA-covered species. All told, less than 20% of the study population answered the question entirely correctly, indicating that these participants had inadequate knowledge of this basic element of the AWA. This lack of knowledge may be especially concerning to animal research scientists, given that the study participants were psychology majors who, unlike many in the general public, likely were exposed to animal research through some of their university courses.

Because some researchers have reported that exposure to animal research practices are related to an individual's attitude toward animal research,[8-10] the purpose of study 1 was to assess the knowledge of a general population regarding some of the basic components of the AWA and AWR. In light of earlier findings,[18] respondents were predicted to have little knowledge of these regulations. Study 2 was designed to provide participants with some exposure to the regulations to determine whether this knowledge influenced their attitudes toward animal research. Participants who were exposed to elements of the AWA and AWR (and thus, have increased knowledge of these laws) were expected to show attitudes more in favor of animal research procedures than were participants provided general information about animal research. If the data support this hypothesis, then educating the general public about the many federal rules and regulations that govern animal research activities may be useful to move public opinion toward more favorable views on animal experimentation.

Because other researchers have reported that psychology majors demonstrated inadequate knowledge of basic elements of the AWA (that is, which species are covered by the law),[18] study 1 was designed to assess members of a general population (that is, not university students) regarding their knowledge of the species covered by the AWA, as well as the makeup and duties of mandated IACUC, committees whose members are to "assess the research facility's animal program, facilities, and procedures."[2,3] In essence, the function of the IACUC is to ensure enforcement of federal regulations at research facilities where covered species are used in research. It was hypothesized that respondents would have little knowledge of these basic aspects of the AWA and AWR.

The goal of study 2 was to expose participants to elements of federal legislation to determine whether exposure to these regulations changed their attitudes to be more favorable of using animals in research procedures. Given the positive association between increased exposure to animal research procedures and practices and more favorable attitudes toward animal research,[9,10] those participants exposed to elements of the AWA and AWR were predicted to demonstrate more positive attitudes toward using animals in research than were respondents who were not similarly informed.

Materials and Methods

Participants. Participants in study 1 comprised 198 people (122 men, 76 women; age [mean ± SD], 34.08 ± 11.03 y) recruited via Amazon's Mechanical Turk (MTurk). This sample was heterogeneous in terms of geographic location, in that the participants were located in all regions of the United States (35 states were represented in the sample). Among the respondents, 35% indicated that they had completed a high-school education, 19% had completed some college, and 46% had completed college. The criteria for inclusion in this study were: (1) participants were located in the United States; (2) they had completed at least 1000 different Human Intelligence Tasks in MTurk, and (3) they had an MTurk approval rate of at least 95%.

The subjects for study 2 comprised 114 people (74 men, 40 women; age, 32.21 ± 9.75 y), recruited via MTurk. As with the participants from study 1, this group of respondents came from all regions of the United States, with 33 states represented in this sample. Among the participants, 12% indicated that they had completed high school, 36% had completed some college, and 52% had completed college. The same criteria for participant inclusion in study 1 were used in study 2.

Materials. For study 1, the Knowledge of Animal Research Regulations questionnaire (KARR) was created to assess participants' knowledge of specific provisions in the AWA and AWR (Figure 1). This questionnaire measured participants' knowledge of species covered by this legislation as well as of IACUC membership and duties. For each question, participants could choose as many responses as necessary to answer each item, and the order of the response choices was randomized for each participant.

A previously reported Attitudes Toward Animal Research questionnaire (ATAR) was used in study 2 (Figure 2).[7,15]. The ATAR consists of 14 items that assess a participant's opinions regarding the value gained from doing animal research and alternatives to animal research and his or her behavioral choices (becoming vegetarian) as they related to animal welfare. For each of the 14 items, participants respond on a 5-point scale (1, strongly disagree; 2, disagree; 3, undecided; 4, agree; and 5, strongly agree). In addition, 2 sets of research facts were generated by the author. One set of facts relayed general information about animal research and veterinary care, whereas the other set of facts relayed specific information about provisions in the AWA and AWR (Figure 3).

Procedure. Participants in study 1 were recruited via MTurk, and each participant was paid $0.30 in exchange for their participation. The opportunity for participation in this study was

Indicate which species of the following species are regulated by the AWA

- Rats and mice bred for research
- Birds
- Fish and amphibians
- *Dogs
- Reptiles
- *Guinea pigs and hamsters
- *Primates
- *Cats

The AWA and AWR requires that facilities using animals for research purposes appoint an IACUC to oversee the facility and the research activities performed at the facility. Indicate which individuals are required to be part of the IACUC.

- *A Doctor of Veterinary Medicine (DVM)
- An animal research scientist
- A nonscientist
- *A person who is not affiliated in any way with the animal research facility (he or she does not work at the facility nor has any immediate family members who work at the facility)

Indicate which of the following activities are required of the IACUC

- *Review and investigate all concerns involving the care and use of animals
- *Review all proposed activities related to the care and use of animals
- *Review, at least every 6 mo, the facility's program for humane care of animals
- Inspect, at least every 6 mo, all animals in the research facility
- Review the personnel qualifications of all researchers using animals in research
- *Inspect, at least every 6 mo, the animal facility

*, Correct response

Figure 1. Knowledge of Animal Research Regulations questionnaire (KARR) used in study 1.

Research on animals has little or no bearing on problems confronting people.

An intrinsic interest in the animal for its own sake is ample justification for doing animal research.

I am very concerned about pain and suffering in animals.

I would rather see humans die or suffer from disease than to see animals used in research.

Since many important questions cannot be answered by doing experiments on people, we are left with no alternative but to do animal research.

I have seriously considered becoming a vegetarian in an effort to save animal lives.

New surgical procedures and experimental drugs should be tested on animals before they are used on people.

There are plenty of viable alternatives to the use of animals in biomedical and behavioral research.

Many important biomedical breakthroughs are a consequence of animal research.

Animals should be granted the same rights as humans.

Most psychologic research done on animals is unnecessary and invalid.

We need more regulations governing the use of animals in research.

Most laboratory animals are better housed, fed, cared for, and protected from pain and suffering than many humans.

Animal research cannot be justified and should be stopped.

Figure 2. Attitudes Toward Animal Research questionnaire (ATAR) used in study 2.

posted to MTurk, and a link to an externally housed online survey was provided. After reading the informed consent document and clicking on the 'I agree' button, participants were directed to answer demographic questions. Prior to exposure to the items on the KARR, participants were provided with the following statement:

Facts about the AWA

The Animal Welfare Act (AWA) is legislation enforced by the USDA and is designed to protect certain animals (including those used in research) from inhumane treatment and neglect. The AWA has been in effect for almost 50 y.

Species protected by the AWA include, but are not limited to, monkeys, dogs, cats, guinea pigs, and hamsters.

The AWA requires an IACUC to review all proposed activities related to animal care and use. If not approved by the IACUC, a research procedure cannot be started.

Facilities that use animals in research are required by law to have a veterinarian review all research procedures as a member of the IACUC.

The AWA requires that animals in pain and distress be given pain-reducing medications. If pain or distress cannot be relieved, the AWA requires the procedure to stop or the animal to be painlessly euthanized.

The AWA allows a veterinarian to stop any procedure if the vet believes an animal is experiencing more than momentary pain or distress that cannot be relieved.

The AWA prohibits research facilities from using stolen animals for research experiments.

The AWA requires all animal research facilities to be inspected at least twice each year by the IACUC, and can be inspected at any time by the USDA.

Facts about animal research

Researchers using animals in experiments follow various laws and guidelines.

Species used in research include, but are not limited to, monkeys, dogs, cats, guinea pigs, and hamsters.

Animal researchers have a plan (protocol) for the procedures they will do in an experiment.

Animals sometimes experience pain and distress in research experiments.

Veterinarians work in clinics, private practice, and industry.

One job of a veterinarian is to care for and treat a wide variety of animal species.

Research facilities purchase animals for experiments from facilities that breed animals specifically for research purposes.

Research facilities are located in medical centers, universities, and for-profit research centers.

Figure 3. Facts about the AWR and animal research.

The Animal Welfare Act (AWA) was initially passed by the United States Congress in 1966 and has been amended 8 times since (1970, 1976, 1985, 1990, 2002, 2007, 2008, and 2013). This legislation requires that basic standards of care and treatment be provided for certain animals bred and sold for use as pets, used in research, transported commercially, or exhibited to the public (Animal Care, 2012). The following questionnaire will assess your knowledge of these federal regulations as they pertain to animals used for biomedical and behavioral research purposes.

After reading this brief explanation of the AWA, participants were directed to answer the questions on the KARR. All procedures were approved by the Ashland University Human Subject Review Board prior to the commencement of these procedures, and all participant responses were submitted anonymously via the MTurk platform to protect the confidentiality of respondents.

As with study 1, participants in study 2 were recruited via MTurk, which linked them to an online survey where they completed the ATAR. After reading consent documentation and providing demographic information, participants were given the ATAR, with the order of the 14 items randomized for each participant (hereafter referred to as Time 1). Immediately afterward, one-half of the participants were instructed to read the general animal research facts, whereas the other one-half of participants were instructed to read the facts about AWA regulations. After reading these statements, participants again completed the ATAR, with the order of the 14 items once again randomized for each participant (hereafter referred to as Time 2). As was the case in study 1, each participant was paid $0.30 in exchange for their participation, and all procedures were approved by the Ashland University Human Subject Review Board prior to the commencement of these procedures. As in study 1, responses were submitted anonymously to protect the identity of the participants.

ATAR scores were calculated by summing the values for each of the 14 items (Figure 2) to generate an overall attitude toward animal research value. Participant scores could range from a low of 14 (attitudes supportive of animal research) to a high of 70 (attitudes against animal research). According to the wording of each item, high scores on some items indicated favorable attitudes toward animal research, whereas high scores on other items were reflective of unfavorable attitudes toward the use of animals in research. Therefore, some of the values

were reverse-coded so that, for all responses, high scores were reflective of negative attitudes toward animal experimentation.

One-sample *t* tests were calculated to determine whether participant responses exceeded chance for study 1, with chance serving as the test variable. In study 2, a 2 × 2 mixed ANOVA was calculated to assess potential differences between the groups. A reliability analysis of ATAR scores for the 2 administrations was calculated by using the Cronbach α test. All analyses were computed with SPSS (version 19, IBM, Armonk, NY), and α was set at 0.05 as the level of significance for all statistical analyses.

Results

In response to the first question of study 1, 79%, 89%, 89%, and 68% of the participants correctly identified that primates, dogs, cats, and guinea pigs or hamsters, respectively, were covered by the AWA. In addition, only 41% 29%, 44%, and 49% of respondents correctly indicated that rats and mice bred for research, birds, reptiles, and fish and amphibians, respectively, were not AWA-covered species. Overall, 5 participants (2.5% of the sample) answered the first question entirely correctly. Participants in study 1 fared only slightly better on questions about the makeup and duties of the IACUC compared with their knowledge of AWA-regulated species. Participants correctly identified a Doctor of Veterinary Medicine (72%) and nonaffiliated member (39%) as required members of the IACUC but incorrectly named an animal research scientist (70%) and nonscientist (15%) as mandated members of the IACUC. Cumulatively, 14 participants (7.1% of the sample) answered this question entirely correctly. When asked about mandated duties of the IACUC, participants correctly identified reviewing the facility's program (66%), reviewing all activities related to the care and use of animals (61%), reviewing all animal concerns (63%), and inspecting the animal facility (71%) as duties of the IACUC required by the AWA. However, participants incorrectly identified reviewing the personnel qualifications of researchers using animals in research (52%) and inspecting, at least once every 6 mo, all animals in the research facility (60%) as mandated duties of the IACUC. In results similar to the question on the makeup of the IACUC, 13 participants (6.6% of the sample) answered this question about the duties of the IACUC entirely correctly.

Correct responses for these 3 questions were tabulated, and analyses indicated that respondents performed no better than chance for questions on the species covered by the AWA (t_{197} = 1.91, $p > 0.05$) or the mandated IACUC members ($t_{197} = 0.45$, $p > 0.05$). Although participant scores were significantly better than chance on the third question that assessed IACUC duties (t_{197} = 2.84, $p < 0.05$), the overall pattern of responses clearly indicated that this sample of respondents had little knowledge of these provisions of the AWA and AWR.

In study 2, participant scores for the Time 1 administration of the ATAR were centered approximately at the midpoint between low and high scores (mean, 39; 1 SD, 10). Scores on Time 2 were likewise centered near the midpoint of the distribution (mean, 38; 1 SD, 10). The Cronbach α test indicated good reliability of the ATAR for both administrations (Time 1, α = 0.89; Time 2, α = 0.90).

To determine whether exposure to information about the AWA and AWR altered participants' attitudes toward animal research, a 2 × 2 mixed ANOVA was conducted, with time serving as a within-subjects variable (Time 1 compared with Time 2), and group serving as the between-subjects variable (AWA/AWR facts compared with general animal research facts). This analysis confirmed the lack of a main effect of group on ATAR scores ($F_{1, 112} = 1.19$, $p > 0.05$, $\eta^2 = 0.01$). There was a significant main effect of time, with scores significantly lower Time 2 ($F_{1, 112} = 14.55$, $p < 0.01$, $\eta^2 = 0.12$). In addition, a significant time × group interaction was revealed ($F_{1, 112} = 5.01$, $p < 0.05$, $\eta^2 = 0.04$). To more fully examine the significant interaction between time and group, planned paired-samples *t* tests at Time 1 and Time 2 revealed a significant difference in ATAR scores for participants exposed to AWA facts ($t_{56} = 4.25$, $p < 0.01$) but no significant difference in ATAR scores for participants exposed to general animal research facts ($t_{56} = 1.12$, $p > 0.05$). Therefore, as predicted, exposure to basic elements of the AWA and AWR influenced participants' attitudes toward the use of animals in research (Figure 4). Alternatively, the attitudes of those participants who were exposed to general statements about animal research (without information about the legislation designed to protect animal subjects) remained unchanged over the 2 administrations of the ATAR.

Discussion

The results of this study suggest that the general public is largely unaware of several of the basic elements of the AWA and AWR (that is, the species covered and IACUC membership and duties) and that brief exposure to basic provisions in this legislation may alter people's attitudes toward animal experimentation. Furthermore, in addition to the AWA and AWR, other governing bodies and sets of regulations that protect animals in research settings (PHS Policy, the *Guide for the Care and Use of Laboratory Animals*, and AAALAC, for example) are in place, and many animal research laboratories adhere to these regulations. However, as stated by the USDA, "other laws, policies, and guidelines may include additional species coverage or specification for animal care and use, but all refer to the Animal Welfare Act as the minimum acceptable standard".[2,3] Therefore, the scope of the current research was to measure participants' knowledge of the AWA and AWR provisions specifically, because they are considered the minimal acceptable standard for animal care and use. When the public is largely uninformed about the federal requirements designed to protect research animals from abuse and neglect, people may form their own assumptions about such regulations (or their believed lack of such regulations), perhaps based on information supplied by animal rights or animal welfare groups. My survey results suggest that researchers who use animal subjects in biomedical and behavioral experiments should strive to disseminate AWA and AWR information to the public. Such information may counter that provided by animal rights or animal welfare groups.

In study 1, only 2.5% of the sample answered the first question (species covered by the AWA) entirely correctly. Although this percentage is considerably lower than that reported previously (19%),[18] direct comparisons between the current and previous samples should be made with caution. First, the previous sample[18] consisted entirely of undergraduates studying psychology who may have had more knowledge of animal research from their university courses than did the current sample. Secondly, there were differences in both the wording (use of the term 'pigeons'[18] compared with the generic term of 'birds' used here) and response alternatives ('fish and amphibians' was not included in the previous study,[18] which did include a 'none of these animals' option). Even without making direct comparisons to the previous results, clearly few of the respondents had complete knowledge of some of the species covered by the AWA.

Scientists who believe that animal research is an important means for improving the lives of both humans and animals should strive to increase public awareness regarding the benefits that animal research provides and the legislation that protects animal subjects from abuse and neglect. Increased knowledge about animal experimentation reportedly was associated with

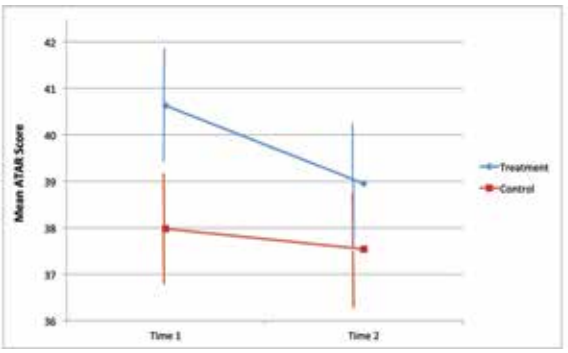

Figure 4. Mean scores on 2 administrations (Time 1 and Time 2) of the ATAR questionnaire for participants exposed to general animal research facts (Control) and participants exposed to AWA and AWR information (Treatment). Error bars, SEM.

attitudes more favorable to animal research.[9,10] Many of the participants in the cited studies[9,10] were university students (who had presumably taken courses involving animal experimentation or were enrolled in medical or veterinary school), whereas the general population may not have these same opportunities for exposure to this information. Therefore, the present data suggest that in addition to promoting the benefits of animal research, those involved in animal experimentation perhaps should consider educating the public on the many rules and regulations that govern such activities. Informing the public about the federal regulations in place that protect research animals from abuse and neglect may contribute to an increased understanding of and appreciation for animal research from those who would be otherwise uninformed.

Traditionally, the majority of human behavioral data are gathered in laboratory settings; however, participants in this study were recruited via MTurk. I sought to recruit participants who were not university students for the current studies because I wanted to measure the knowledge and attitudes of a more diverse cross-section of the general population; soliciting participants through MTurk provided an opportunity to reach a broader audience. Although participants recruited on MTurk arguably may not be representative of the general population, the samples for both studies were diverse in terms of education level, geographic location, and age. In addition, given that many 'MTurkers' are located outside of the United States (approximately 1/3 of the workers on MTurk reside in India),[17] restrictions were incorporated so that only domestic participants would be recruited, thus reducing the likelihood that language barriers would affect the results. Even with potential differences between MTurkers and members of the general population, several studies using various behavioral and decision-making tasks have reported that MTurk data are as reliable and valid as are those gathered in traditional, laboratory settings.[4,14,17] Other researchers may wish to draw from samples recruited by using traditional techniques to replicate the findings presented here.

In summary, these data suggest that educating the public about the rules and regulations in place for the protection of animal subjects may be an effective means to improve attitudes toward animal research. In college students, education about animal research practices reportedly was associated with increased appreciation for animal research,[9,10] and the current study suggests that providing persons with (albeit limited) information about federal regulations immediately produced changes in their attitudes toward animal experimentation. If attitudes more favorable toward animal research can be produced by briefly exposing participants to statements regarding the protection of animals in research settings, how much more substantially could such attitudes be altered by deliberately and broadly disseminating information regarding the laws that protect animals in the laboratory?

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